

Project Summary

During this investigation, near-net-shape Vacuum Plasma Spray (VPS) forming techniques were developed to produce advanced components with internal features such as Smart Heat Pipes and Crucibles. The initial results demonstrated the ability to incorporate features such as channels and a porous layer within the wall of a Smart Crucible. During Phase II, the investigation focused on the development of a near-net-shape formed Smart Heat Pipes for use in a high temperature environments. A summary of the results from this investigation is given below:

- VPS forming techniques were developed that enabled the fabrication of Smart Heat Pipes and Crucibles.
- Testing showed VPS Mo-Re deposits can have properties equivalent to or better than the properties of Mo-Re materials produced with conventional powder metallurgy processing techniques.
- Molybdenum wick structures with high porosity levels can be produced using VPS processing techniques.
- Permeability testing has shown the pores of the VPS molybdenum wick structures are interconnected.
- Electron beam welding techniques were developed for welding VPS Mo-Re heat pipes.
- Smart Heat Pipes comprised of an integral molybdenum wick and a dense Mo-Re close-out layer were produced with Mo end caps and a Mo fill tube.
- Inspections of the heat pipes showed they were leak tight, i.e., leak rate less than 10^{-6} sccs of helium.
- The three Smart Heat Pipes ready for filling with liquid metal were delivered to NASA.